TECHNICAL MEMORANDUM NO. 71-02

IMPROVED RATION HEATER AND FUEL TABLET

INTERIM REPORT

By
Frederick M. Drake
Environment and Survival Branch

August 1971

APPROVED FOR PUBLIC RELEASE:
DISTRIBUTION UNLIMITED.

U. S. ARMY LAND WARFARE LABORATORY
Aberdeen Proving Ground, Maryland 21005

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ABSTRACT

An investigation of the thermal properties of acetal resins led to the development of a fuel tablet for heating combat rations. Burning with a light blue flame, no smoke or odor, the fuel tablet attains a flame temperature of approximately 1900°F. This material is also chemically stable over a wide temperature range (-60 to 320°F.), requires no special overwrap and has an indefinite shelf life.

Troops in the field were reported using the B-1A type combat ration can as a field expedient stove. Elaborating on this concept, a two piece grid to hold the can of rations above the flame was developed to be used with this field expedient stove, thus providing an improved ration heater.

FOREWORD

A limited investigation was conducted to determine the feasibility of utilizing acetal resins as fuel for heating combat rations. Small quantities of fuel tablets, molded from acetal resins, were produced and tested in the laboratory. Results of the tests were favorable and the scope of work was expanded for the purpose of optimizing the fuel tablet and developing a ration heater for operational use in the field.

Helpful assistance was provided by personnel of the DuPont Company in the formulation of the fuel tablet and acknowledgment is hereby given to Mr. William C. Wall and Dr. Glen M. Kuettel, E. I. DuPont de Nemours and Company, Inc., Plastics Department, Wilmington, Delaware; also, the Technical Support Division, U. S. Army Land Warfare Laboratory, Aberdeen Proving Ground, Maryland.

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Introduction

Trioxane, the standard Army fuel tablet, vaporizes (sublimates) and therefore requires a special overwrap to prevent loss of the tablet. A small pinhole in the overwrap can, in time, result in complete loss of the tablet. Test quantities of Trioxane tablets procured by the U. S. Army Land Warfare Laboratory have, without exception, all shown varying degrees of degradation, indicating a limited shelf life. Also, troop units in the field report problems in obtaining Trioxane fuel and, when available, they must resort to field expedient stoves. These are limited, of course, to each man's own resourcefulness. A ration stove or stove kit is not available as a standard Army item and in this report a method is described whereby troops can quickly convert a ration can to a serviceable ration stove by use of a simple grid. This report also summarizes the development of the acetal resin fuel tablet, discusses its use in a ration can stove and offers a solution to the problem of issue of these items to troops.

Conclusions

The acetal resin fuel tablet requires no overwrap and has an indefinite shelf life. It burns with a light blue flame and no smoke, thus minimizing the possibility of giving away one's position under combat conditions. It is more economical than the current standard fuel. For distribution, it could be packed with the combat rations, easing logistic problems associated with other fuels.

The grid for use with a field expedient stove is lightweight (one ounce) and adds very little to the soldier's load. It is a reusable or throw-away item and could be packed with the combat rations as the P38 can opener is.

Discussion

Background

During an investigation to develop a Disposable Airdrop Container, studies were made of various plastics which might be suitable on the basis of their combustible and structural properties. One plastic, acetal resin, was acceptable on assessment of its outstanding combustible properties but was subsequently ruled out for lack of technological capability in the fabrication of a container by current rotational molding methods. However, this study did suggest the possible use of acetal resins as a fuel for heating combat rations.

A small study task, "Fuel Units of Acetal Resins", was initiated and a limited investigation was conducted to determine feasibility. Results of the investigation were favorable and a report of findings is included in Appendix A.

Fuel Tablet

The fuel tablet is an acetal resin which is a thermoplastic polymer manufactured by the polymerization of formaldehyde. It weighs approximately 1/2 ounce and is disc shaped 2 5/8 inches in diameter by 5/32 inches thick. Selection of the disc shape was based upon the fact that it provided a lower profile in the ration can stove and would not interfere with use of the grid and also this shape allowed for packaging with the combat ration meal discussed further in this report. The outside edge of the tablet is cut at a 45° angle, tapering to a feather edge .010 inches thick for quick ignition with a match. Each tablet is slotted so that two tablets can be joined to form a cruciform or "X" shape. Two tablets joined in this manner constitute a fuel unit. It was noted during this investigation that fuel unit configuration is very important in maintaining structural stability during the early phases of the burning cycle. This was accomplished by the "X" shape of the fuel unit and igniting the fuel so that it burned from the top to its base. Because this fuel changes from solid to liquid during combustion, the "X" shape begins to slump during the initial phase of burning and after approximately three minutes is completely liquid. The fuel unit burns with very little signature, only a light blue flame, no smoke or odor, leaves little or no residue, attains a flame temperature of approximately 1900°F., and has a combustion heat of 8,000 BTU/Lb. Actual burning time of a fuel unit varies from 12 to 15 minutes, depending upon wind conditions. Combat rations can be heated in from 4 to 6 minutes and 12 ounces of water (343 ml.) in 8 to 10 minutes. If the fuel is inadvertently immersed in water or exposed to rain, it will ignite without difficulty by removing most of the surface moisture. Trioxane, the current standard Army fuel, costs 11 cents per tablet. This compares with 8.2 cents each for the LWL fuel unit (two tablets) in quantities of 60,000 units. This is quite an attractive saving, with the possibility for further savings in increased production quantities.

Ration Can Stove and Grid

It was recognized early in this investigation that a serviceable ration stove would be a valuable adjunct to the fuel tablet since a standard individual stove was not available within the Army inventory.

Reports from field units in RVN and Korea indicated that the current practice is to use the B-1A type ration can as a field expedient stove. Various fuels are used other than the standard Trioxane fuel, including C-4 explosive, sand saturated with gasoline or fuel oils, insect repellent, etc. The advantages of a ration can stove were readily apparent: it is available, it is disposable, economical; a new item is not being added to increase the soldier's load; and it is well suited to the LWL fuel tablet.

A B-1A, B-2, or White Bread can is supplied with each combat ration meal. This is normally the first can opened by troops in the field (or so reported) and makes an excellent field expedient stove. When used as such with the LWL fuel tablet, it is recommended that air holes be placed in the can approximately one-half inch above the bottom to prevent spilling of melted or liquid fuel. These can be punched with a knife, bayonet or beer can opener if available. The number of holes is not critical, however, six to eight are suggested.

To effectively use this field expedient stove, a means of supporting the ration can of food to be heated (or canteen cup of water) was desirable and thus the LWL grid was developed. It consists of two rectangular sections of light gage mild steel which, when assembled, form an "+" configuration. Appropriately notched to fit on a B-1A ration can stove, the grid provides a one inch high "standoff" from the stove. A ration can of food can then be set on top of the grid (also notched to hold it in place) or a canteen cup of water can be set in position and heated.

The grid is fabricated from C1018/C1020 mild steel, .0359 inches thick (20 gage). Two sections comprise a unit, each 3 7/16 inches long by 1 5/16 inches wide and weighing 1 ounce per unit. Each section is identical and incorporates a slot which enables them to be joined to form the "+" shape. In addition to supporting the can of food or canteen cup, the grid also allows for secondary combustion air for the fuel unit and acts as a chimney to release the products of combustion.

It is estimated that production quantities of the LWL grid can be fabricated at a cost of six cents each. Most likely the grid would be used for at least three meals before being discarded, however, this would depend upon user resupply.

Suggested Basis of Issue

Both the grid and fuel tablets could be packaged with the standard combat ration. The grid could be packaged in the same manner as the P38 can opener and placed in the main carton. Four grids per carton would provide four men the means of heating three meals per day. The disc shaped fuel tablet fits neatly under (or on top of) a ration can and four tablets (two fuel units) could be packaged in this manner in the individual combat meal carton and utilize already available space. It is envisioned that one fuel unit would be used to heat the ration and one to heat the beverage water.

Results

Tests were conducted by military personnel attached to the U. S. Army Land Warfare Laboratory and, in general, the results were satisfactory. However, there were some problems encountered which can be overcome. Typical criticisms were as follows:

1. Hard to ignite (tablets) - in a stiff breeze the tablets are hard to ignite in the open. They should be ignited under these circumstances either in a sheltered spot or placed in the ration can stove prior to igniting. Also as mentioned under the discussion, ignition should be at the top of the tablet.

2. Insufficient heat produced by the tablet - under extremely windy or cold conditions three tablets can be used for additional heat. The third tablet is placed under two tablets joined in the "+" configuration. Also, a sheltered area can usually be constructed free from the wind.

3. Grid height is excessive - it has been suggested that reducing the grid height to bring the food can closer to the fire is desirable. If further testing confirms this, the grid height can be reduced easily.

4. When the flame is extinguished in a closed area stinging of the eyes occurs with an obnoxious odor - in most instances the flame or fuel will be allowed to burn to completion and no emission will be noted. However, if the burning fuel tablet is extinguished as noted, a small amount of formaldehyde is given off which is unpleasant but harmless.

Results of informal tests by Company B (GS) 82D Aviation Battalion, Fort Bragg, North Carolina and the Ranger Department, USAIS, Fort Benning, Georgia are included in Appendix B.

More formal evaluation tests are currently (January-February-June 1971) being conducted by U. S. 8th Army in Korea. For this evaluation, 12,000 fuel units and 600 grids were provided with a Proposed Evaluation Plan and an Evaluator's Checklist (Appendix C). Results of this evaluation are not available at this time.

APPENDIX A

Final Report
Fuel Units of Acetal Resins
GNI Task 06-SA-68

Investigation

Acetal resins in various combinations and configurations were investigated to determine optimum burning characteristics. Celcon and Delrin are two commercial grades available, however, Delrin was used because of its availability to this Laboratory.

Powdered Delrin was briquetted (starch binder) with charcoal, diatomaceous earth, and powdered silica. Delrin was also melted or liquified in a closed vessel and these materials mixed in the melt in various proportions. Combustion tests were conducted with each combination under conditions of reduced as well as unlimited amounts of air. Poor burning characteristics combined with release of free formaldehyde resulted during these initial tests.

Efforts were then directed toward combustion of pure Delrin in various configurations, for heating water for cooking and other purposes such as melting snow or ice for drinking water. Basic components used during this phase of the investigation were the U. S. Army canteen cup and an aluminum stove designed by the U. S. Army Natick Laboratories, which was adapted to the canteen cup. Rectangular sections of Delrin 1/8 inch thick by 2 1/4 inches long by 1 1/2 inches wide, in a cruciform shape, were placed on an aluminum foil base in the stove. Some ignition problems resulted, although a small rectangular section of waxed paper placed in a slot in the Delrin worked quite well. Three sections of Delrin were used and notched so as to form the cruciform shape. During each test, 400 ml. of water (14 ounces) were placed in the canteen cup and temperature rise vs. time data was obtained. In general, approximately ten minutes was required to bring the water temperature from 20°C. to 80°C. which is considered suitable for reconstituting dehydrated foods. A graph showing typical heating rates for Delrin and Trioxane is attached to this report (Figure 1). This graph is included to show the relative shape or displacement of the heating curves. It is not intended to depict an absolute or quantitative comparison of the BTU output of the two fuels. Figure 2 is a photograph of the test equipment.

A typical fuel packet would consist of the three sections of Delrin, one section waxed paper and an overwrap of aluminum foil. Packet weight is slightly less than one ounce (28 gms.), occupies a volume of 1.64 cubic inches (27 cc.), and costs three to four cents. Delrin is unaffected by environmental conditions and can be carried or stored indefinitely. Also, it is nonpoisonous and nonreactive under normal conditions of usage.

When used under operational conditions, Delrin burns with only a light blue flame; it is smokeless and odorless and leaves no residue. It also attains a flame temperature of 1900°F. and may be used for soldering or brazing in an emergency. Table I gives pertinent physical properties.

Other heat tablets in present use include US (Trioxane), UK (Hexamine), and a recent development by the U. S. Army Natick Laboratories utilizing a methyl alcohol-kapok tablet. Trioxane and the methyl alcohol-kapok tablet require a vapor proof overwrap to prevent evaporation or sublimation. From a practical standpoint, this presents a serious use and storage problem in the event of pinholes or rupture of the overwrap.

The Trioxane tablet is a standard U. S. Army item weighing 27 grams and costing 11.0 cents each. With the exception of cost and the storage problem, it is an excellent fuel, heating 400 ml. of water from 30°C. to 80°C. in 6.5 minutes. Methyl alcohol-kapok fuel tablets were developed under a joint effort of the U. S. Army Natick Laboratories and RACIC for the Royal Thai Army and cost 2.4 cents each. It is also a good fuel tablet, heating 400 ml. of water from 30°C. to 80°C. in 7.6 minutes.

Results

The results of this study indicate that Delrin fuel packets may be acceptable as a standard U. S. Army item. When used with the Natick stove and standard Army canteen, Delrin is an excellent fuel. A comparison of Delrin with other fuels is given in Table II.

It was noted during this investigation that fuel configuration of Delrin is very important in maintaining structural stability during most of the burning cycle. This was accomplished by the cruciform shape, although there may be other configurations which would satisfy this requirement.

Table I

Properties of Delrin

	British Units	Metric Units
Specific Heat	0.35 BTU/Lb./°F.	0.35 kg. cal./kg.°C.
Flame Temp.	19,000°F.	10,500°C.
Heating Value	8,051 BTU/Lb.	4,472 kg. cal./kg.
Self Ignition Temp.	707°F.	376°C.
Flash Ignition Temp.	613°F.	323°C.
Chemical Resistance	Outstanding resistance to neutral chemicals including a wide variety of solvents.	

Table II

Comparison of Fuel Packets

Properties/ Performance	Methyl Alcohol- Kapok	Trioxane	Hexamine	Acetal Resin- Delrin
Wt. - gms.	23	27	27	28
Volume - cm.	80	36	20	27
Cost	2.4¢	11.0¢	8.5¢	8.2¢
Shelf Life	Poor	Poor	Good	Excellent
Toxicity	Yes	No	Yes	No
400 ml. H_2O (14 ozs.)	30°C.	30°C.	30°C.	20°C.
Heated to	80°C.	80°C.	80°C.	80°C.
Time to Heat - min.	7.6	6.5	6.5	10.0
Deg./Min.	6.58	7.69	7.69	6.0

Comparative Heating Rates
of Water (400 ml.)

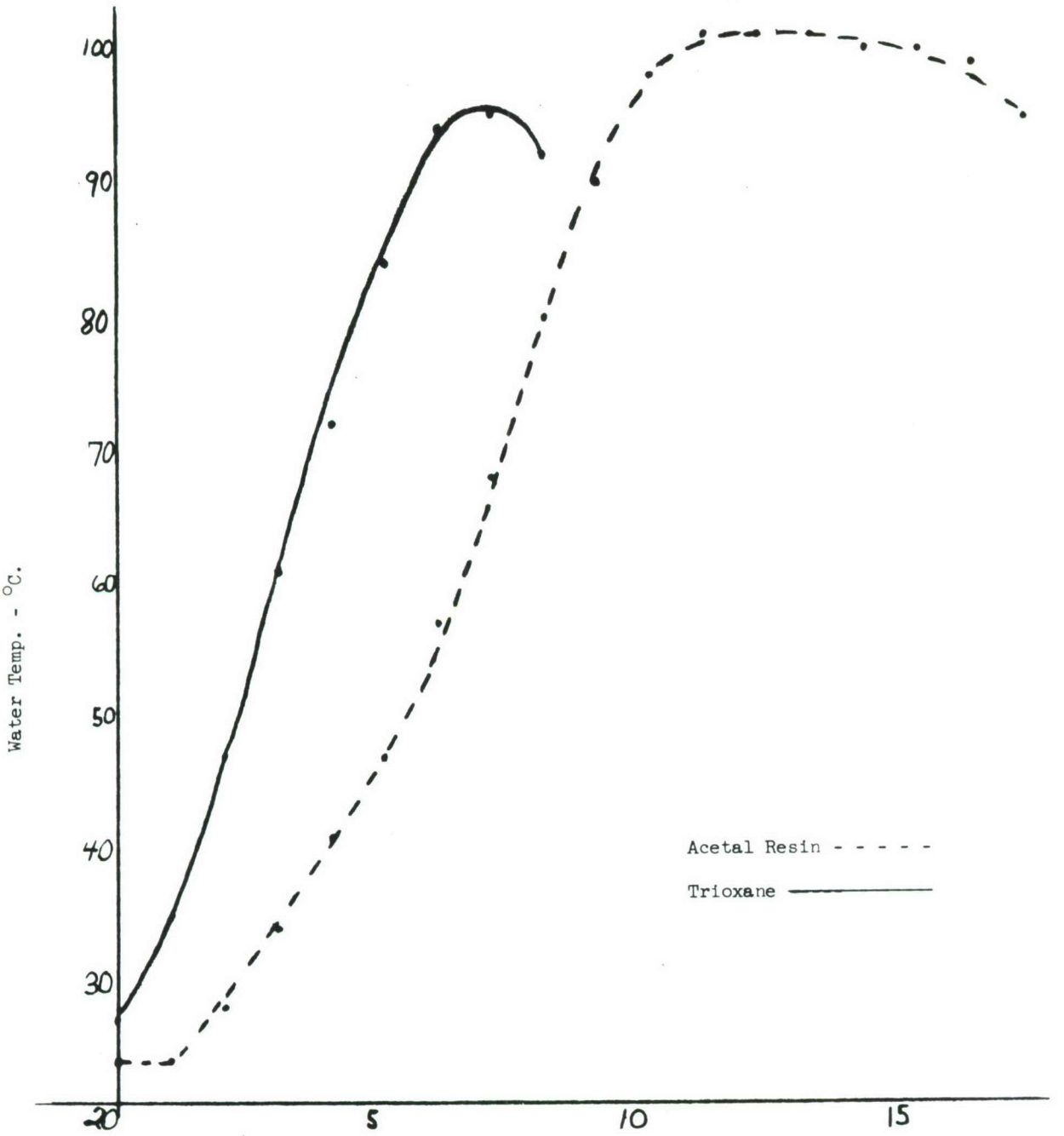


Figure 1.

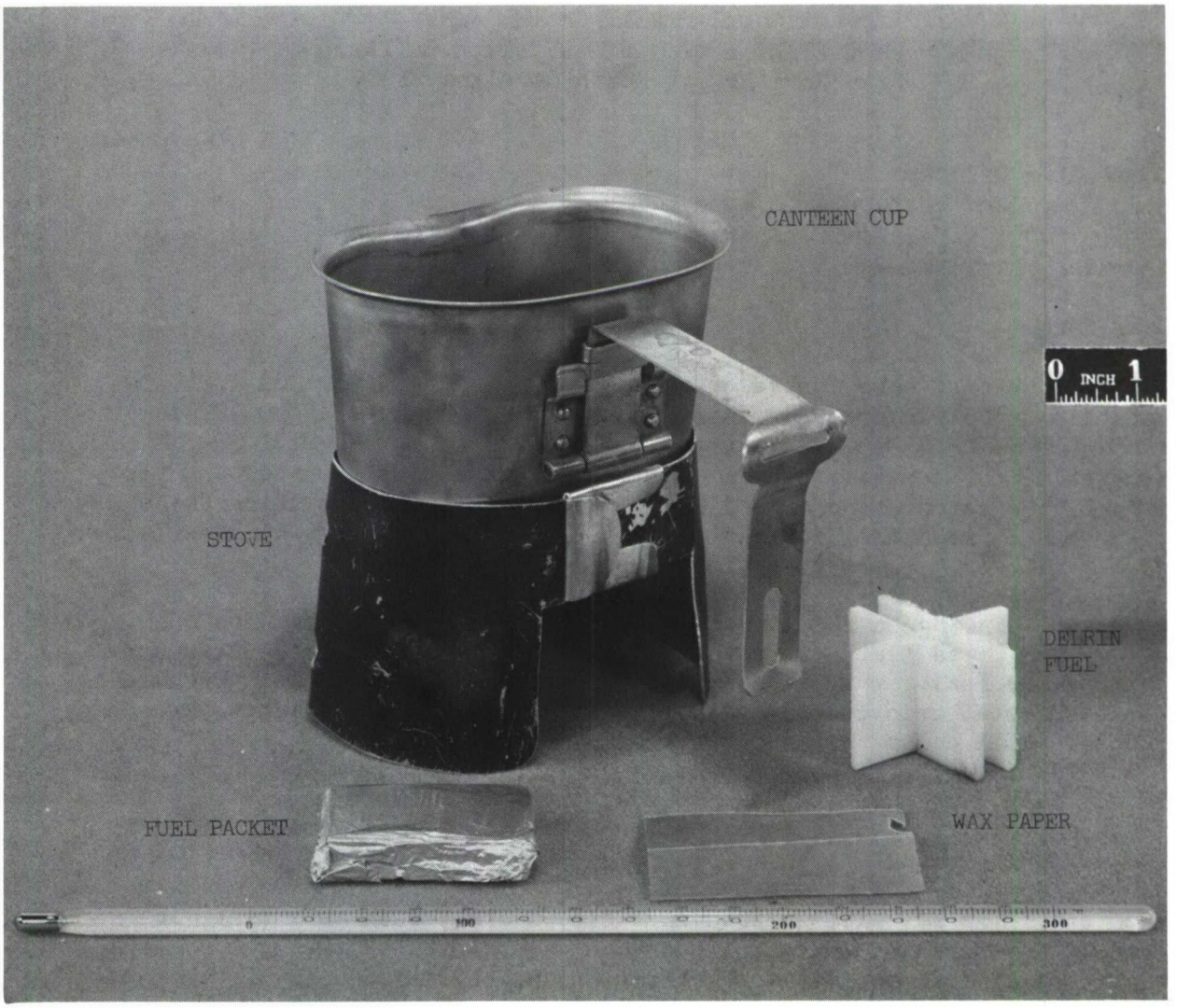


Figure 2. Test Equipment

APPENDIX B

DEPARTMENT OF THE ARMY
COMPANY B (GS) 82D AVIATION BATTALION
Fort Bragg, North Carolina 28307

4 December 1970

Commanding Officer
U.S. Army Land Warfare Laboratory
ATTN: CRD IWL7A, Joe Swisher
Aberdeen, Maryland 21055

Dear Sir:

The food heaters were tested by members of Company B (GS) 82d Aviation Battalion, 82d Airborne Division, in the field November 17-20 1970.

Some soldiers, contrary to the accompanying directions, placed the food directly on top of a punctured C-ration can, instead of putting the enclosed grid between the fire and the can of food. The fire was never more than a flicker, because not enough air reached the fuel.

Others obtained good results when placing the C-rations can upon one grid plate layed flat across the top of the punctured C-ration can containing the fuel. This suggests the desirability of reducing the height of the erected grid by one-half, which will still allow air to reach the fuel but will bring the food can closer to the flame.

In addition, the gauge of the metal in the grid seems unnecessarily thick. A thinner gauge, even if bent prior to use, could easily be restored to a usable configuration.

When the flame was extinguished in a closed area, such as a tent, it limited an extremely obnoxious odor and was painful to the eyes. Perhaps there could be an appropriate warning on the envelope.

When in an area free from any draft, the fire burned hot and was more than adequate for heating C-rations. However, when exposed to the slightest breeze, all heat seemed to dissipate between the fuel and the bottom of the C-ration can.

All things considered, using personnel were enthusiastic about the heating kits. They are compact and easy to carry, easy to use, and it is not usually difficult to construct a small area free from wind.

JOHN A LASCH III
MAJ IN
Commanding

DEPARTMENT OF THE ARMY

USAMC INFANTRY RESEARCH AND DEVELOPMENT LIAISON OFFICE

FORT BENNING, GEORGIA 31905

AMXFR

27 November 1970

SUBJECT: Informal Evaluation/LWL Fuel Tablet

Commanding Officer
U. S. Army Land Warfare Laboratory
ATTN: CRDLWL-5, MAJ W. H. Mercer
Aberdeen Proving Ground, Maryland 21005

1. At the request of the Land Warfare Lab this office arranged for the Ranger Department, USAIS to informally evaluate the fuel tablet. A total of 85 fuel tablets were consumed during the evaluation. Seventeen individuals participated in the evaluation. Each participant was issued five fuel tablets. The training was conducted at the Ranger training sites located in Stewart County, Georgia and Eglin Air Force Base, Florida. Climatic conditions were roughly equivalent to those experienced in the highlands of the Republic of Vietnam. A copy of the check list executed by each participant is attached (Incl 1). The information following is a recapitulation of the results taken from the questionnaire executed by 17 Ranger trainees:

Are directions or instructions clear? 16 Yes, 1 No

Is the fuel tablet easily ignited? 6 Yes, 11 No

Does the tablet heat water hot enough to reconstitute dehydrated rations? 6 Yes, 5 No, 6 No Test

Were you able to heat "combat rations" satisfactorily? 10 Yes, 7 No

Did you have any problem using the grid with a ration can stove? 3 Yes, 14 No

How many times did you use each grid? 3 to 5 times

If you used the canteen cup to heat water on the grid, did you find it satisfactory? 8 Yes, 5 No

AMX-LR 27 November 1970
SUBJECT: Informal Evaluation/LWL Fuel Tablet

Under what type of weather conditions did you use the LWL tablet and grid on the ration can stove? 17 Dry (10 Satisfactory, 4 Unsatisfactory, 3 No Comment)

Do you consider the LWL fuel tablet and grid with the ration can stove an acceptable means of heating rations? 7 Yes, 8 No, 2 No Comment

2. Briefly summarizing the opinions of the participants based on their questionnaire and oral discussion, general comments as follows pertain:

Hard to ignite.

Tablets should be packaged with rations.

Canteen cup unstable on grid.

Insufficient heat produced by tablet.

3. It should be pointed out that this was only an informal evaluation. No assurance can be given as to the type of control maintained over the test item or for that matter any other aspect of the so called test. This report should be treated accordingly and further testing under more optimal conditions is undoubtedly warranted.

4. This activity is willing to assist LWL in any way with regard to further development of the subject item.

Robert H. Robinson

ROBERT H. ROBINSON
Colonel, Infantry
Commanding

1 Incl
as

APPENDIX C

PROPOSED EVALUATION PLAN FOR LWL GRID AND FUEL TABLET LWL TASK 04-S-70

1. References:

a. CDOG-QMDO para 1412 b (2) Individual Fuel Element (U) - A fuel for heating individual rations and small shelters which will not disclose the soldier's position by odor, smoke, or light.

b. Memo for Record, MOD, dtd 7 Jan 70, Subj: Fonecon from MAJ Mercer from Korea, 7 Jan 70 (Incl 1).

c. Memo for Record, MOD, dtd 9 Jan 70, Subj: Fonecon, USALWL LO, 9 Jan 70 (Incl 2).

2. Purpose: The purpose of this plan is to determine the suitability and acceptability of the LWL Grid and Fuel Tablet for heating combat rations and water for beverages or dehydrated rations (LRPR), on the ration can stove.

3. Proposed Method of Evaluation: Supply sufficient quantities of fuel tablets and grids to one infantry company, average of 100 men per company in the field for 30 days, eating two meals per day and using two fuel units (four tablets) per meal. This would require 12,000 fuel units. Six grids per man are recommended or 600 per company.

4. Background: Various fuel tablet configurations were tested to determine the best shape and weight for ignition and combustion. A disc shape incorporating a slot equal in length to the radius of the disc was finally selected. The purpose of the slot is to join the two sections to form a cruciform or "X" shape. Two tablets joined in this manner constitute a fuel unit weighing approximately one ounce. This will supply enough heat to boil 12 ounces of water (one-half canteen cup) in 8-10 minutes. Combat rations can be heated in 4-6 minutes.

Trioxane, the current standard Army fuel, costs 11¢ per tablet. This compares with 8.2¢ each for the LWL fuel unit in quantities of 60,000 units (120,000 tablets). This is quite an attractive saving, with the possibility for further saving in increased production quantities.

It was early recognized that an efficient ration stove would be a valuable adjunct to the fuel tablet, and in that a standard individual stove was not available within the Army system, a ration stove development was initiated.

Reports from field units in RVN, Korea, etc. indicated that current practice is to use the B-1A type ration can as a makeshift stove. Various fuels are used, including the standard Trioxane fuel tablet, C-4 explosive, sand saturated with gasoline or fuel oils, insect repellent, etc. The advantages of a ration can heating stove were readily apparent, including availability, it is disposable, economical, a new item is not being added to increase the soldier's load, and it is suited to the LWL fuel tablet. However, to effectively use this makeshift stove, a means of supporting the ration can or canteen cup of water was desirable, and thus the LWL grid was developed. It consists of two rectangular sections of light gage steel which, when assembled, forms an "X" configuration. Appropriately notched to fit on a B-1A ration can, the grid provides a one inch high "stand-off" from the stove. A ration can of food can be set on top of the grid (also notched to hold it in place) or a canteen cup of water can be set in position and heated.

It is estimated that production quantities of the grid can be fabricated at a cost of 6¢ each. It is believed the grid would be used for at least three meals before being discarded.

It is proposed that both the fuel unit and grid be packaged with the standard combat ration. The grid could be packaged in the same manner as the can opener and placed in the main carton. Four grids per carton would provide four men the means of cooking three meals per day. The disc shaped fuel tablet fits neatly under a ration can and four tablets (two fuel units) could be packaged in this manner thus utilizing already available space. The LWL Acetal Resin (Delrin) fuel tablet is non-toxic, does not sublimate (vaporize), is unaffected by moisture, and is readily adaptable to packaging with food rations.

The current standard Trioxane fuel cannot be packaged with food because it does sublimate and could contaminate food. Although it is packaged in a vapor-proof overwrap, the smallest pinhole will allow leakage and eventual loss of the fuel. This results in a limited shelf life for Trioxane, whereas the LWL fuel tablet has an unlimited shelf life.

5. Description:

a. LWL Fuel Tablet - The fuel tablet is an Acetal Resin (Delrin) which is a thermoplastic polymer manufactured by the polymerization of formaldehyde. The tablet weighs 1.0 ounce, and is 2 5/8 inches in diameter by 5/32 inches thick. The outside edge of the tablet is cut at a 45° angle, tapering to a thin flash .010 inches thick for quick ignition with a match. The tablet burns without a signature, namely, with a blue flame, is smokeless and odorless, leaves little or no residue, attainsa flame temperature of 1900°F.,

and has a heat of combustion of 8,000 BTU/LB. The fuel undergoes a liquid phase upon burning and must be contained during the final stages of combustion. Actual burning time varies between 10 and 15 minutes, depending upon wind conditions.

b. LWL Grid - The grid is fabricated from C1018/C1020 mild steel .0359 in. thick (20 gage). Two sections comprise a unit, each 3 7/16 inches long by 1 5/16 inches wide and weighing 1 ounce per unit. Each section is identical and incorporates a slot which enables them to be joined forming an "X". Essentially, the grid is a "stand-off" separating the ration can stove from the can of food or canteen cup. In addition to supporting these items, it also allows for secondary air for combustion of the fuel tablet and acts as a chimney to release the products of combustion.

c. Ration Can Stove - A B-1A, B-2 or White-Bread Can is supplied with each Combat Ration Meal. This is normally the first can opened by troops in the field (or so reported), and makes an excellent makeshift stove. When used as such with the LWL fuel unit, it is recommended that holes be placed in the can approximately 1/2 inch above the bottom to prevent the spilling of melted fuel. These can be punched with a knife or bayonet or with a bear can opener if available. The number of holes is not too critical, however, six to eight are suggested.

6. Objectives: The objectives of the evaluation are to (1) determine if the fuel unit provides sufficient heat to raise water to a temperature (175°F. minimum) suitable for reconstituting dehydrated rations, heat combat meals and ease of igniting and using the tablet and (2) to determine the effectiveness of the grid and stove combination under field conditions and their acceptability by troop units.

7. Support Requirements: The personnel support requirements can be furnished by the evaluating unit.

8. Time Schedule: A 30-day time frame should be sufficient to accomplish the stated objectives.

9. Safety and General Precautions: Acetal Resins burn with a pale blue flame and are difficult to see under normal daylight conditions. If the user is not certain that the tablet is burning, he should not touch the tablet, but hold his hand two to three inches above the tablet. He will feel heat on his hand from a burning tablet, but will not receive a burn. Also, this tablet goes through a liquid burning phase and care should be exercised not to spill the liquid on one's skin or clothing. If it is desired to put out the burning tablet, smother with dirt or water. The burning liquid fuel will not spatter or react to water.

EVALUATOR'S CHECKLIST

NAME RANK JOB TITLE

UNIT DATE

1. Are directions or instructions clear? Yes ___ No ___ If no, what changes do you suggest? _____

_____

2. Is the fuel tablet easily ignited? Yes ___ No ___ Comments _____

_____

3. Does the tablet heat water hot enough to reconstitute dehydrated rations? Yes ___ No ___ Comments _____

_____

4. Were you able to heat "combat rations" satisfactorily? Yes ___ No ___ Comments _____

_____

5. Did you have any problem using the grid with a ration can stove? Yes ___ No ___ Comments _____

_____

6. How many times did you use each grid? _____

7. If you used the canteen cup to heat water on the grid, did you find it satisfactory? Yes ___ No ___ Comments _____

_____

_____

8. Under what type of weather conditions did you use the LWL tablet and grid on the ration can stove (rain, high wind, dry, etc.)?

_____

Were the results satisfactory under some or all of the conditions?

Comments _____

_____

9. Do you consider the LWL fuel tablet and grid with the ration can stove an acceptable means of heating rations? Yes ___ No ___ Comments

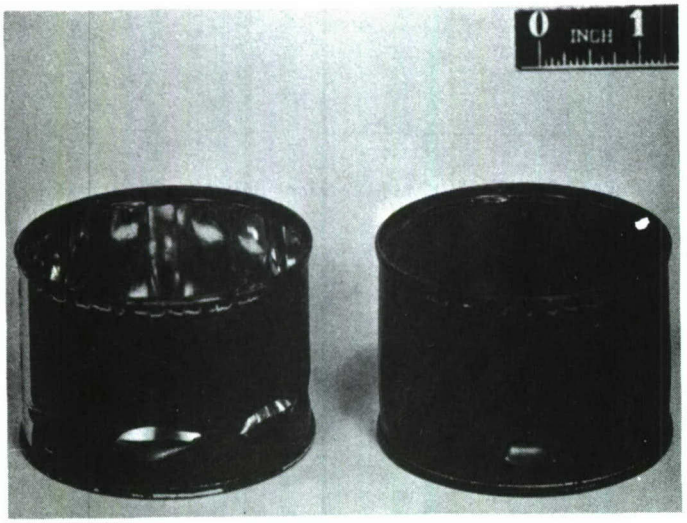
_____

_____

_____

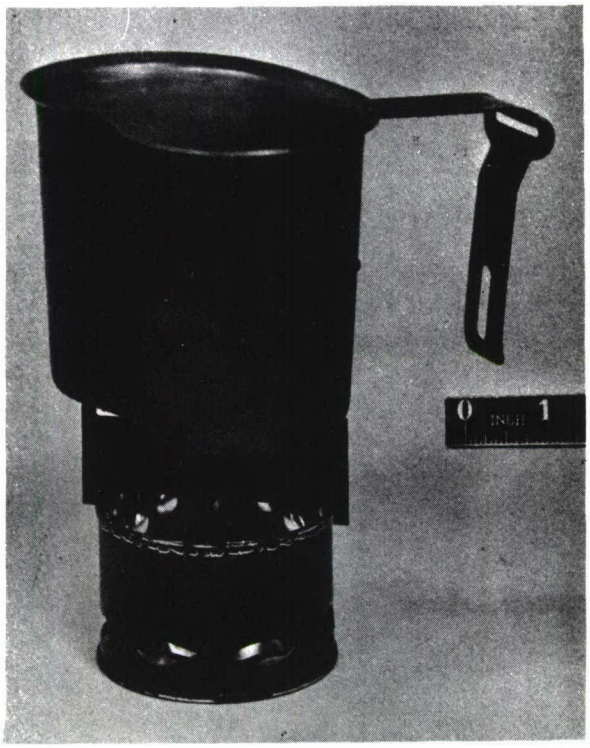
_____

SUGGESTED "C" RATION CAN STOVE

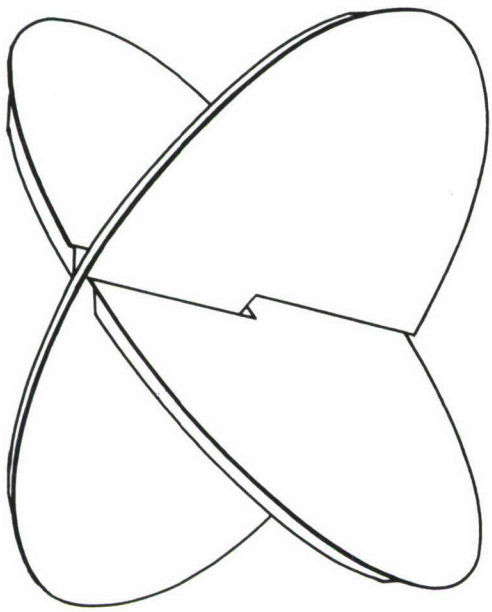


Cut holes in empty "C" Ration can as shown in picture. Use bottle opener, bayonet or knife. Bottom holes must be approximately 1/2 inch above bottom of can because the fuel tablet melts and is burned as a liquid.

This photo shows method of heating can of "C" ration. Contents of "C" ration can may also be placed in Canteen Cup, which is then placed over stove. Be sure to stir food contents in either case to prevent burning.



Method of heating water for dehydrated rations or for beverage. Use 3/4 Canteen Cup water (12 oz) for dehydrated rations and 1/2 Canteen Cup (8 oz) for beverage.



Assemble two fuel tablets as shown in photo to form a fuel unit. Light the thin edge with a match, preferably in two places for quick ignition. Fuel may be held in the hand when lighting and then dropped into "C" ration can or under windy conditions, place fuel unit in can and light with match through punched holes near bottom of can.

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